NASAfacts

TAPSS

Terminal Area Precision Scheduling System

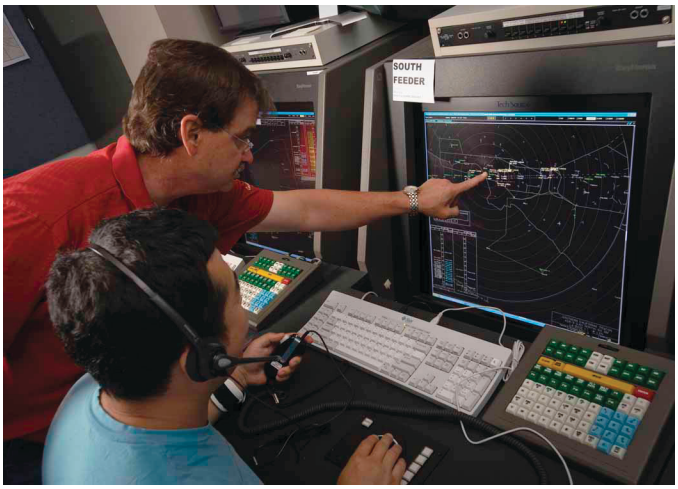
Air traffic controllers currently rely on simple decision support tools to safely separate and maintain an orderly flow of aircraft within the National Airspace System (NAS). As the volume of air traffic grows, greatly enhanced tools will be needed in order to maintain and increase system performance. To help controllers keep up with the anticipated heavy workload, NASA is developing several advanced automation tools that will provide controllers with more accurate predictions about the nation's traffic flow, weather, and routing. The greater precision in this information will enable a next-generation air traffic management system (referred to as NextGen), which will be safer, greener, and more efficient. These new tools require increased information sharing and coordination among air traffic controllers and pilots within the NextGen future. A critical goal in NASA's air traffic management research and development process is ensuring that these tools work well together.

The ***Terminal Area Precision Scheduling System (TAPSS)*** research at NASA Ames Research Center tests the integration of many of NASA's technologies that aim to improve operations in the airspace immediately surrounding the airport, known as the terminal area. These technologies include:

- Precision scheduling enhancements to the previously deployed Traffic Management Advisor (TMA), which creates time-based metering arrival schedules for terminal-merge points
- Required Navigation Performance/Area Navigation (RNP/RNAV), which enables aircraft to fly more fuel efficient routes from cruise altitude to landing
- Controller Managed Spacing (CMS) tools, which provide speed advisories for metering in the terminal airspace
- Efficient Descent Advisor (EDA), which enables aircraft to use minimum fuel consumption descents while being metered in busy terminal areas, thereby minimizing environmental emissions

TAPSS research uses human-in-the-loop simulations to evaluate the performance of the NextGen tools in congested airspace where there is a significant need for high-precision automation aids. Such airspace includes the Southern California Terminal

NASA researchers participate as air traffic controllers during Terminal Area Precision Scheduling System (TAPSS) shakedown simulations in NASA's Air Traffic Management Laboratory. *Photo credit: NASA/Dominic Hart*



NASA researchers evaluate the performance of NextGen air traffic management technologies during TAPSS simulations. *Photo credit: NASA/Dominic Hart*

NASA researchers test pilot aircraft simulation workstations during TAPSS shakedown simulations in NASA's Air Traffic Management Laboratory. *Photo credit: NASA/Dominic Hart*

Radar Approach Control (TRACON) Metroplex, an airspace environment comprising multiple large, interdependent airports. Several traffic scenarios with varying levels of complexity are studied using models of traffic into Los Angeles International Airport, a high-flow airport. The concept of precision metering with staged delay distribution is evaluated to account for uncertainty within the airspace system. Traditionally, most arrival delay is absorbed near the airport where controllers and pilots use vectoring, or circling, to accommodate delay, which increases congestion in the terminal area. By applying simple variations in speed from cruise altitude to landing, instead of vectoring in the terminal area, small amounts of delay are distributed over the length of a flight, relieving some of the congestion that builds up near the airport. This leads to a much more efficient flow into busy terminal areas, less fuel burn, and reduced workload for pilots and controllers. Both nominal and off-nominal conditions are tested to understand the robustness of the automation under anticipated air traffic growth projections for NextGen.

Recent simulations modeled three Air Route Traffic Control Center (or simply, "Center") arrival-metering sectors and five TRACON (three feeder and two final) sectors with controller positions interacting with workstation-based pilot/aircraft simulation positions. The current air traffic control paradigm of voice and radio-based arrival clearances is used, allowing for near-term implementation into the NAS. Simulation participants, who often include experienced air traffic controllers and pilots, provide feedback on performance, workload, and acceptability in order to improve the functionality of the automation. Data on delay and controllability of the traffic along RNP/RNAV routes is collected during each simulation and the results will be compared against current-day operations. The data collected may also provide insights into changes in airspace volume and fuel savings.

NASA and the Federal Aviation Administration (FAA) have formed a research transition team (RTT) focused on "Efficient Flow Into Constrained Airspace," with the objective of increasing the FAA's awareness of NASA's air traffic management research and progress. The RTT aims to enable a smooth handover of NASA-developed research targeted for the operational environment. TAPSS research contributes to the FAA's goal to improve the flow of traffic in constrained airspace. The precision scheduling enhancements to the Traffic Management Advisor are a part of the FAA's plans for Time-Based Flow Management Concept Exploration, which also contribute to the goals of the RTT.

Another goal of the TAPSS research is to further develop air traffic management simulation capabilities and to validate the infrastructure for studying integrated NextGen tools in complex human-in-the-loop simulations. In the future, TAPSS will explore the issues of arrival schedule non-conformance and recovery from the air traffic controller's perspective to provide insight into the development of automated schedule recovery tools.

For more information on the Terminal Area Precision Scheduling System (TAPSS), please visit:
www.aviationsystems.arc.nasa.gov.

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